5. Blue Spruce Uplands Ecological Series

Table 05-1. Full names and short names for the ecological types in the Blue Spruce Uplands Ecological Series.

Ecological Type Code	Name	Plant Association Code	Short Name
FD15	Blue spruce/Arizona fescue open forest–Argiborolls–Gentle to steep easterly slopes and benches, 9,200-10,200 ft	PIPU/FEAR2	Blue spruce/Arizona fescue–Dark clay soils–Easterly
FD16	Blue spruce-Engelmann spruce/kinnikinnick–Cryoboralfs or Eutroboralfs–Gentle northerly slopes, 9,400-10,500 ft	PIPU-PIEN/ARUV	Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly

This upland *Picea pungens* Series is described here for the first time, and it is based, in part, on the *Picea pungens* (blue spruce) Series of Moir and Ludwig (1982), Layser and Schubert (1979), B. Alexander and others (1984), Mauk and Henderson (1984), Youngblood and Mauk (1985), Alexander (1985-1988), Fechner (1985), Komárková (1986-1988), DeVelice and others (1986), Fitzhugh and others (1987), B. Alexander and others (1987), Larson and Moir (1989), Muldavin and others (1990), and Moir (1993).

Though the Blue Spruce Series is considered part of the "southwest mixed-conifer forests" (Alexander and others 1987), in the UGB these forests are among the least mixed. In many stands, the only conspicuous plant species are those in the name. Though common in Southwestern mixed-conifer forests, Douglas-fir, subalpine fir, and ponderosa pine are usually absent or nonreproducing in the UGB. White fir (*Abies concolor*) and southwestern white pine (*Pinus strobiformis*), common to the southwest, do not occur in the UGB. Stands of this series occupy sites that are large to very large, covering considerable areas of landscapes.

Vegetation, Soils, Climate

Blue spruce uplands occur on valley sides where cold-air drainage is a conspicuous factor in local climate (microclimate) (Moir 1993). These stands occur in cold, deep-rainshadow climates on soils with a conspicuous Argillic horizon. The moisture-loving overstories and dry understories of these stands seem a strange combination, but the gravelly soil surface is very dry, absorbing precipitation quickly (Fitzhugh and others 1987). The soil layer just above the Argillic is moist enough to support the moisture-loving spruces. The layers are, from the tops of the trees to the bottom of the soil, moist-dry-dry-moist.

Table 05-2. Climate

Characteristic	Value	Reference
Precipitation zone	400-610 mm/yr 16-24 in/yr	Local data

Blue spruce is only slightly susceptible to western spruce budworm (*Choristoneura occidentalis*), which is more common in Douglas-fir forests. Western spruce budworm infestation in blue spruce in the UGB rarely seems to cause mortality.

Timber Management

Blue spruce and Engelmann spruce are commonly managed trees in these stands in the UGB. Aspen is sometimes managed in seral stands where it is dominant. Our stands support very little subalpine fir or ponderosa pine, though this type is rated as good for growing Douglas-fir to the south of the UGB (Larson and Moir 1989). Tree productivity varies widely; for example, the spruce/kinnikinnick type is rated low to moderate productivity (see Moir and Ludwig 1979), while the spruce/Arizona fescue type has very low tree productivity. Timber management practices would likely initiate mass soil movement (Komárková and others 1988), and the stands are too patchy to effectively manage for timber. Many Blue Spruce Series stands occur on shallow slopes, and productivity is at least moderate. Considerable timber harvest activity has occurred on these sites in past decades.

Clearcutting can be a successful management method that favors light-demanding ponderosa pine and aspen regeneration. Shelterwood cuts are usually successful. Heavy shelterwood cuts favor regeneration of ponderosa pine, while lighter cuts favor blue spruce. Selection cutting favors blue spruce (Larson and Moir 1989). Natural revegetation is often unsuccessful, since disturbance dries the soil even more than it is naturally. Spruces have low natural seed viability and germination success, so natural regeneration of trees is also sparse.

Fire Management

Before Euro-American settlement and fire suppression, frequent small-scale surface fires were common in blue spruce forests. Dry-season fires may have been sustained by herbaceous cover. Some fires may have originated as range fires in dry parklands bordering these stands (Moir and Ludwig 1979). Before 1900, recurrent fires in the

warm, grassy sites within this Series created open, parklike stands with conspicuous ponderosa pine and Douglas-fir. Recurrent low-intensity fires kept aspen and blue spruce at densities lower than at present (Moir 1993). Since 1900, fire suppression in these stands has resulted in dense stocking with fire-sensitive aspen and blue spruce.

Range and Wildlife Management

Forage production ranges from very little in older stands of spruce/kinnikinnick to moderately high in seral aspen stands and open stands of spruce/fescue. Aspen-dominated stands and open stands of spruce/fescue receive fairly heavy use by livestock (B. Alexander and others 1984).

Stands provide good summer range for deer, elk, and a wide variety of birds and small mammals (Moir and Ludwig 1979). Deer and elk use the stands for cover and forage in the summer (Alexander and others 1984). These relatively closed forests are of small extent within the low-elevation bighorn sheep range west of Saguache, just outside the UGB (Shepherd 1975). These forests are probably unimportant as bighorn sheep habitat, and may in fact act as barriers to bighorn, since visibility from these stands is characteristically poor.

Recreation, Roads & Trails, Scenery

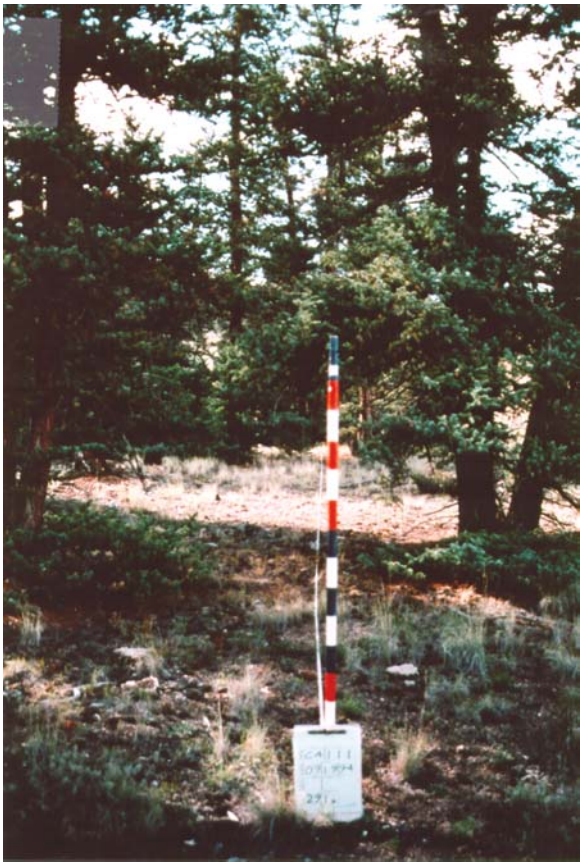
Blue spruce sites are generally suitable for roads and trails. Sites are stable, with low slope angles, and the understory vegetation tolerates trampling well. These sites are generally suitable for dispersed camping or recreation development, because soils are stable and slope angles are characteristically shallow (Fitzhugh and others 1987, Moir 1993). Where aspen is a conspicuous component of the overstory, sites are not suitable for campgrounds because damage to aspen trees often leads to increased disease and death of the aspen component. Scenic quality of these stands is often high, especially in open, park-like stands (Fitzhugh and others 1987), or when aspen is seral (DeVelice and others 1986)

Key to Ecological Types in the Blue Spruce Uplands Series

1. Arizona fescue or mountain muhly prominent, >5% cover. Dark-surface (Mollic) soils. Blue spruce dominant, >20% cover, in a patchy stand of tree "islands" alternating with grasslands. Engelmann spruce absent or minor, <10% cover. Soil surface usually gravelly, gravel >10% cover.....FD15
1. Arizona fescue absent or <2%, mountain muhly absent. Light-colored soils (Cryoboralfs or Eutroboralfs). Blue spruce absent, dominant, or codominant, 0-65% cover. Stand is usually less patchy, more continuous. Engelmann spruce sometimes prominent, sometimes absent, 0-60% cover. Soil surface usually not gravelly, or if so, gravel <10% cover.....FD16

Table 05-3. Characteristics of Ecological Types within Ecological Series 5 in the Upper Gunnison Basin. Numbers are shown in form *Average (Minimum-Maximum)*

Code Short Name	No. Samples	Elevation, ft	Avg. Aspect, °M (r) Slope, %	Soil Coarse, %	Depth, cm Mollic, cm	Surface: Coarse, % Bare, %	Cover, % Trees Shrubs Graminoids Forbs	Total Live Cover, % No. Species TLC/NS, %
FD15 Blue spruce/Arizona fescue–Dark clay soils–Easterly	6	9,838 (9,280-10,140)	73 (0.52) 27 (5-70)	53 (47-58)	42 (32-52) 14 (2-26)	25 (0-70) 18 (1-30)	70 (25-112) 13 (0-41) 49 (25-86) 21 (7-63)	152.9 (84.4-284.5) 23 (19-28) 6.6 (3.0-10.9)
FD16 Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly	6	9,800 (9,400-10,480)	336 (0.58) 15 (9-24)	51 (29-65)	58 (47-73) 7 (0-12)	4 (1-12) 5 (0-15)	88 (61-123) 28 (10-56) 27 (1-90) 14 (1-23)	157.5 (101.1-270.6) 28 (24-39) 5.8 (3.7-10.8)



A typical blue spruce/Arizona fescue stand (Community Type B) on a bench above Cochetopa Park, in a deep-rainshadow, dry, cool environment. Blue spruce 57% cover, Arizona fescue 12%, blunt sedge 10%, mountain muhly 2%. The stand is composed of two contrasting patches: groups of relatively short blue spruce trees, and open patches of Arizona fescue and other grasses. The type is named for these two species because the patches are small and in close proximity, in spite of the fact that the two species almost never occur really together. Arizona fescue is a strongly sun-loving (heliophilous) species. There is neither true fir nor Douglas-fir in this stand, as typical for the type. Coarse Fragments Cover = 19%, Total Live Cover = 92%, Coarse Fragments in Soil = 45. Soil sampled as a Lithic Argiboroll, Loamy-Skeletal, Mixed. Cochetopa Park Quadrangle, elevation 9,280 ft, 5% 037° (NE) slope. September 19, 1994.

FD15 **BLUE SPRUCE/ARIZONA FESCUE–DARK CLAY SOILS–EASTERLY** PIPU/FEAR2

Blue spruce/Arizona fescue open forest–Argiborolls–
Gentle to steep easterly slopes and benches, 9,280-10,140 ft

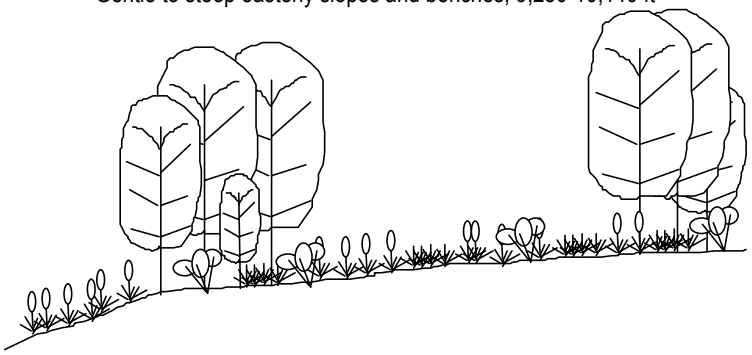


Figure 05-1. Cross-section of vegetation structure of *Blue spruce/Arizona fescue–Dark clay soils–Easterly*. Aspects are easterly, and slope angles average 27%.

Blue spruce/Arizona fescue–Dark clay soils–Easterly is an uncommon type on gentle to moderate slopes within deep rainshadows. In the Gunnison Basin, this type occurs on gentle Montane slopes in deep rainshadows. It has also been described from southwestern Colorado and northern New Mexico. *Blue spruce/Arizona fescue–Dark clay soils–Easterly* is characterized by blue spruce (PIPU) and Arizona fescue (FEAR2). See Table 05-7 for common species names and codes. Patchy stands and location within deep rainshadow are also distinguishing features.

Blue spruce/Arizona fescue–Dark clay soils–Easterly stands typically consist of patches of trees (blue spruce with aspen) alternating with open patches of grasses (Arizona fescue). Surprisingly, mountain muhly is not very common in this type. The conifer canopy is always very open. Patches of aspen correspond to areas of different soils. Conifers establish infrequently in the soil patches with a denser Argillic horizon and a slope position with a favorable water supply for blue spruce. This type is part of the plant association *Picea pungens/Festuca arizonica (*Fitzhugh 1983). The *Danthonia parryi* phase of *Picea pungens/Festuca arizonica* is described as new here, though it is represented in some of De Velice's (1985) plots.

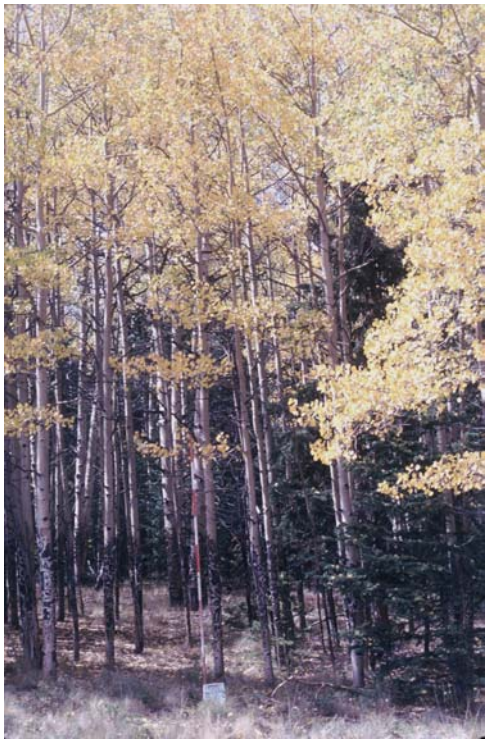
Blue spruce/Arizona fescue–Dark clay soils–Easterly is related to *Ponderosa pine/Arizona fescue–Light-colored clay soils*, which occurs at somewhat lower elevations and on southerly slopes, with light-colored soils, in the same rainshadow watersheds. Spruce/kinnikinnick communities adjoin this type on colder slopes at higher elevations. Big sagebrush/oatgrass-Arizona fescue occurs adjacent in parks, and tall willow (yellow, Booth, blue, serviceberry) riparian communities border it in bottoms.

Moderately-heavy to heavy grazing by cattle, sheep, deer, elk, or antelope tends to increase bare soil and decrease graminoid cover. Horizontal obstruction is high to very high because of the dense "islands" of trees. Hence, deer and elk use these stands moderately during mild winters. Deer and elk use of stands is moderate during mild winters for forage, cover, and rest, but low in severe winters. The sites see moderate to moderately low use for forage and cover spring through fall by deer and elk. Antelope have been seen in these stands, because they are often adjacent to open sagebrush. The sites are not used much by sage grouse, mainly as summer range. There is typically little sagebrush in the stands. Sage grouse use is very low in spring for leks and nesting, but summer use of community type A is moderate and use of community type B is low.

Summary of Ecological Type Characteristics

1. Explanation of symbols in Appendix A. Percentages in [brackets] indicate the percentage of plots sampled that have that characteristic

NUMBER OF SAMPLES	6, soil descriptions from 2 of these (total 6)
ELEVATION	9,838 ft (9,280-10,140 ft); 2,998 m (2,828-3,091 m)
AVERAGE ASPECT	73°M (r = 0.52)
LITHOLOGY	Tuff and welded tuff
FORMATIONS[1]	Taf
LANDFORMS	Soil creep slopes [80%] and benches
SLOPE POSITIONS	Backslopes [75%] and footslopes
SLOPE SHAPES	Linear [75%] to undulating horizontally, Linear [75%] to concave vertically
SLOPE ANGLE	26.9% (5-70%)
SOIL PARENT MATERIAL	Colluvium
COARSE FRAGMENTS	19.7% (0-70%) cover on surface, 52.8% (47-58%) by volume in soil
SOIL DEPTH	42 cm (32-52 cm); 16.7 in (13-20 in)
MOLLIC THICKNESS	14 cm (2-26 cm); 5.6 in (1-10 in)
TEXTURE	Clay loam, silt loam surface; sandy clay, sandy clay loam, or clay subsurface
SOIL CLASSIFICATION	Argiborolls [75%] and Eutroboralfs
TOTAL LIVE COVER	152.9% (84.4-284.5%)
NUMBER OF SPECIES	23.2 (19-28)
TOTAL LIVE COVER/NO. SPECIES	6.6% (3.0-10.9%)
CLIMATE	In deep rainshadow. The typical phase is always found in the Cochetopa Basin, in the southeastern part of the Gunnison Basin. Phase DAPA2 is found in the rainshadows of upper Cebolla Creek and the adjacent Lake Fork.
WATER	The surface of the soil is dry to very dry, but the sharply-defined Argillic horizon holds enough water to maintain blue spruce in at least a sparse stand. No permanent water on or near sites.



Another blue spruce/Arizona fescue stand, with aspen sharing dominance (Community Type A). Aspen 78% cover, blue spruce 34%, kinnikinnick 8%, Arizona fescue 19%, Thurber fescue 16%. Soil sampled as a Typic (or Frigid) Cryoboralf, Loamy-Skeletal, Mixed. Cold Spring Park Quadrangle, elevation 10,060 ft, 7% 325° (NW) slope. September 16, 1992.

Key to Community Types

1. Aspen >40% (20-40% cover), codominant with blue spruce ..... **A**
1. Aspen absent to minor, <10% cover ..... **B**

Description of Community Types

A *Aspen-blue spruce-Arizona fescue-patchy* is co-dominated by blue spruce (20-40% cover) and aspen (40-80% cover). Arizona fescue cover is 5-20%.

B *Blue spruce-Arizona fescue-patchy* has blue spruce 25-60% cover, with no aspen present. Arizona fescue cover is 10-20%.

Table 05-4. Community types within *Blue spruce/Arizona fescue–Dark clay soils–Easterly*.

Community Type	No. Samples	Elevation, ft Slope, %	Coarse, % Depth, cm Mollic Depth, cm	Surface Coarse, % Bare, % Seral Stage	Lr	Layer Height, m	Avg Lyr Cvr %	Cover, %: Trees Shrubs Gramin. Forbs	No. Species Total Live Cover, % TLC/NS, %	Obstruction %: 1.5-2.0 m 1.0-1.5 m 0.5-1.0 m 0.0-0.5 m Total<2m
A. Aspen-blue spruce-Arizona fescue-patchy	3	10,100 (10,060-10,140) 11.5 (7-16)	56 (53-58) 42 (32-52) 9 (2-15)	3 (3-4) * LS-LM	T1 T2 T3 S1 GF S2	14 (10-18) 6 (2.5-10) 1.5 (0.0-2.5) 0.4 (0.2-0.6) 0.2 (0.0-0.9) 0.1 (0.0-0.2)	48 36 6 T 63 11	98 (87-112) 22 (9-41) 67 (49-86) 31 (10-63)	24 (19-28) 218 (180-285) 9.1 (6.8-10.9)	50 50 50 70 55
B. Blue spruce-Arizona fescue-patchy	3	9,663 (9,280-9,890) 37.1 (5-70)	47 43 26	32 (7-70) 18 (6-30) LM	T1 T2 T3 S1 GF S2	12 (8-16) Missing 2.5 (0.5-5.0) Missing 0.2 (0.0-0.7) Missing	47 M 10 M 36 M	42 (25-57) 5 (0-7) 30 (25-37) 11 (7-15)	22 (19-28) 88 (84-92) 4.1 (3.0-4.8)	100 75 65 70 78

*. Unknown: measurements were not taken in this CT.

Table 05-5. Resource Values for *Blue spruce/Arizona fescue–Dark clay soils–Easterly*. Resource values were calculated from the numbers in Table 05-5, relative to the whole UGB.

The numbers in this table can be translated: 0 = Very Low, 1 = Low, 2 = Moderately Low, 3 = Moderate, 4 = Moderately High, 5 = High, and 6 = Very High.

	Community Type			Community Type	
Resource Value	**A**	**B**	**Resource Value**	**A**	**B**
Potential Cattle Forage Production	3-4	3-4	Sage Grouse Lek Potential	1	1
Grazing Suitability	4	4	Sage Grouse Nesting/Brood Potential	1	1
Potential Timber Production	1-2	1-2	Sage Grouse Summer Potential	2-3	2-3
Timber Suitability	ns[1]	ns[1]	Need for Watershed Protection	2	2
Developed Recreation	3	2	Soil Stability	4	3
Dispersed Recreation	4	4	Risk of Soil Loss-Natural	2	3
Scenic	4	4	Risk of Soil Loss-Management	2	3
Road & Trail Stability	4	3	Risk of Permanent Depletion-Range	3	2
Construction Suitability	3	2	Risk of Permanent Depletion-Wildlife	2	1
Deer & Elk Hiding Cover	5	6	Risk of Permanent Depletion-Timber	ns[1]	ns[1]
Deer & Elk Forage & Browse	3	2	Resource Cost of Management	3	3
Sage Grouse Cover	5	5	Cost of Rehabilitation	2	2

*. ns = Not suitable.

Table 05-6. Wildlife values (relative to the whole UGB) for the principal wildlife species using *Blue spruce/Arizona fescue–Dark clay soils–Easterly*. "|" means the same as above.

CT	Sage Grouse Season–Preference	Mule Deer Season–Preference	Elk Season–Preference
A	Spring– Very Low (Lek) Nesting– Very Low Summer– Moderate	Winter, Mild– Moderate (Forage, Cover, Rest) Winter, Severe– Low Spring/Fall– Moderate (Forage, Cover)	Winter, Mild– Mod, Low (Forage, Cover, Rest) Winter, Severe– Low Spring/Fall– Mod. Low (Forage, Cover)
B	Spring– Very Low (Lek) Nesting– Very Low Summer– Low	|	|

Table 05-7. Common Species in *Blue spruce/Arizona fescue–Dark clay soils–Easterly*, where Characteristic cover > 10% or Constancy > 20%. "–" means that the species is not found. Dead cover is not listed. Ccv = Characteristic Cover, Con = Constancy. If Avc = Average Cover, then these are related using the formula Avc = Ccv•100%/Con.

		COMMUNITY TYPE A		COMMUNITY TYPE B		
Code	Species	Ccv N =	(Con) 3	Ccv	(Con) 3	Common Name
	TREES					
PIPU	Picea pungens	31	(100)	39	(100)	blue spruce
PIAR	Pinus aristata	–	–	10	(33)	bristlecone pine
POTR5	Populus tremuloides	55	(100)	–	–	quaking aspen
PSME	Pseudotsuga menziesii	30	(33)	T	(33)	Douglas-fir
	SHRUBS					
ARUV	Arctostaphylos uva-ursi	9	(67)	–	–	kinnikinnick
ARTR2	Artemisia tridentata	10	(33)	T	(33)	big sagebrush
JUCO6	Juniperus communis	10	(67)	1	(67)	common juniper
ROWO	Rosa woodsii	6	(67)	4	(67)	Woods rose
	GRAMINOIDS					
ACHY	Achnatherum hymenoides	–	–	1	(67)	Indian ricegrass
BRPO5	Bromopsis porteri	14	(33)	–	–	nodding brome
CAGE2	Carex geyeri	17	(67)	3	(33)	elk sedge
DAPA2	Danthonia parryi	41	(33)	8	(33)	Parry oatgrass
ELEL5	Elymus elymoides	2	(100)	2	(67)	bottlebrush squirreltail
FEAR2	Festuca arizonica	12	(100)	16	(100)	Arizona fescue
FETH	Festuca thurberi	6	(100)	–	–	Thurber fescue
KOMA	Koeleria macrantha	1	(33)	3	(100)	prairie junegrass
MUMO	Muhlenbergia montana	–	–	2	(67)	mountain muhly
POPR	Poa pratensis	10	(33)	–	–	Kentucky bluegrass
PORE	Poa reflexa	30	(33)	–	–	nodding bluegrass
	FORBS					
ACLA5	Achillea lanulosa	16	(67)	–	–	western yarrow
ARFR4	Artemisia frigida	–	–	2	(67)	fringed sagewort
ASAL7	Astragalus alpinus	3	(33)	1	(33)	alpine milkvetch
GECA3	Geranium caespitosum	–	–	2	(67)	Fremont geranium
HEVI4	Heterotheca villosa	T	(33)	3	(33)	hairy golden aster
LUAR3	Lupinus argenteus	16	(67)	–	–	silvery lupine
MELA3	Mertensia lanceolata	–	–	2	(67)	lanceleaf bluebells
PANE7	Packera neomexicana	–	–	1	(100)	New Mexico groundsel
POHI6	Potentilla hippiana	T	(33)	1	(100)	horse cinquefoil
PSMO	Pseudocymopterus montanus	1	(100)	–	–	mountain parsely
SOSI3	Solidago simplex	1	(33)	1	(33)	Mt. Albert goldenrod
VIAM	Vicia americana	4	(67)	–	–	American vetch
	GROUND COVER					
.BARESO	bare soil	–	–	18	(67)	
.LITTER	litter and duff	97	(67)	56	(100)	
GRAVEL	gravel 0.2-10 cm	–		19		
.COBBLE	cobble 10-25 cm	3	(33)	–	–	
.STONES	stone > 25 cm	–	–	–	–	
.MOSSON	moss on soil	1	(33)	–	–	
LICHENS	lichens on soil	–		3		

BLUE-ENGELMANN SPRUCES/KINNIKINNICK–LIGHT-COLORED SOILS–NORTHERLY

Blue spruce-Engelmann spruce/kinnikinnick–
Cryoboralfs or Eutroboralfs–Gentle northerly slopes, 9,400-10,480 ft

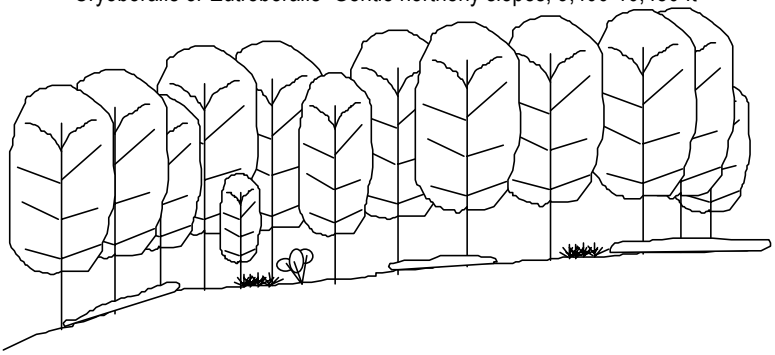


Figure 05-2. Cross-section of vegetation structure of *Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly*. Aspects are northerly, and slope angles average 16%.

Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly is an uncommon type on gentle northerly slopes within the deep rainshadows. In the Gunnison Basin, this type occurs on gentle slopes in the lower-Subalpine in deep rainshadows. It has been described from southern Colorado and northern Utah, usually east of and in the rainshadow of large mountains. *Blue-Engelmann spruces/ kinnikinnick–Light-colored soils–Northerly* is characterized by blue spruce (PIPU), Engelmann spruce (PIEN), aspen (POTR5), kinnikinnick (ARUV), common juniper (JUCO6), and yarrow (ACLA5). See Table 05-11 for common species names and codes. Stands are upland spruce forests, often without fir.

The plant association *Picea pungens/Arctostaphylos uva-ursi* of De Velice (1985) is based in part on *Picea pungens-Pseudotsuga menziesii* phase *Arctostaphylos uva-ursi* described by Moir and Ludwig (1979). Douglas-fir rarely occurs in these stands in the Gunnison Basin, especially in deep rainshadow. *Picea pungens-Picea engelmannii/ Arctostaphylos uva-ursi* phase *Picea engelmannii* is described as new here.

Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly stands typically have dense to closed canopies of spruce (blue or Engelmann), aspen, or lodgepole pine (Douglas-fir in one site). These stands often have neither subalpine (corkbark) fir nor Douglas-fir. Common juniper is common but sparse, and the low shrub kinnikinnick dominates the shrub layers. Herbs are various, often sparse. Moss and lichen cover is common on the soil surface.

Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly is seemingly related to *Douglas-fir/kinnikinnick-Cold to moderately cold*, but the latter occurs in lighter rainshadows at lower elevations.

Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly is related to *Blue spruce/Arizona fescue–Dark clay soils–Easterly*, which occurs on easterly slopes, on somewhat shallower, darker (Mollic) soils, and is associated with Arizona fescue in a patchy forest.

Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly seems like a paradox, with moisture-loving spruce, associated with kinnikinnick, an indicator of dry surface soils. Apparently the spruces find the water they need just above the Argillic horizon in these Alfisols, where water is retained, while the shallow-rooted kinnikinnick responds to the dry climate of the rainshadows where the type occurs.

Moderately-heavy to heavy grazing by cattle, sheep, deer, elk, antelope, or bighorn tends to increase .Where aspen is not present (Community Type A), early seral stages are openings in a spruce forest. Eventually, opening support patches of lodgepole pine or spruce seedlings, which increase in size and density. Management activities that move the shallow, top layer of dark, organic soil slow this process, since nutrients necessary for seedling growth are removed or made unavailable. Kinnikinnick and other ground flora are very important at early stages to stabilize the soil surface, especially at higher slope angles.

When aspen is present (Community Types B and C), early seral stages are patchy stands of aspen sprouts. This aspen cover (and the ground flora it encourages) protects the soil surface and enhances the organic upper soil layers. Patches of aspen cover create a protected bed for conifer seedlings and the nutrients to grow them. Seedlings of lodgepole pine appear first and grow faster in the aspen patches, followed by spruce seedlings. During and after the midseral stage, the stand is a patchy mix of lodgepole pine, young spruce, and older aspen.

Blue spruce/Arizona fescue communities border *Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly* on benches and gentle slopes on lower, warmer, dryer sites. Spruce-fir/moss communities adjoin this type on colder slopes at higher elevations. Thurber fescue grassland may be adjacent in parks with deeper-soils, and tall willow riparian communities (Booth, blue, or serviceberry willows) are found in adjacent bottoms. Bristlecone pine stands adjoin this type on dry, windy, exposed slopes and on ridges.

Horizontal obstruction varies from low to high, mostly created by aspen regeneration. Sites of all community types are inaccessible to deer and elk in the winter, even mild winters, because of snow accumulation.Deer and elk make moderately low use of sites of all community types for cover during spring through fall.

Summary of Ecological Type Characteristics

1. Explanation of symbols in Appendix A. Percentages in [brackets] indicate the percentage of plots sampled that have that characteristic.

NUMBER OF SAMPLES	6, soil descriptions from 5 of these (total 6)
ELEVATION	9,800 ft (9,400-10,480 ft); 2,987 m (2,865-3,194 m)
AVERAGE ASPECT	336°M (r = 0.58)
LITHOLOGY	Igneous: tuff, andesite, breccia, rhyolite
FORMATIONS[1]	Taf [60%], Tpl [40%]
LANDFORMS	Soil creep slopes [60%] and slump-earthflows [40%]
SLOPE POSITIONS	Backslopes [60%], toeslopes, and footslopes
SLOPE SHAPES	Linear [40%] to convex [40%] horizontally, Linear [60%] to concave [40%] vertically
SLOPE ANGLE	15.5% (9-24%)
SOIL PARENT MATERIAL	Colluvium [60%] or colluvium over residuum [40%]
COARSE FRAGMENTS	3.3% (0-12%) cover on surface, 51.0% (29-65%) by volume in soil
SOIL DEPTH	58 cm (47-73 cm); 22.7 in (19-29 in)
MOLLIC THICKNESS	7 cm (0-12 cm); 2.6 in (0-5 in)
TEXTURE	Surface is loamy (loam-sandy loam-sandy clay loam-clay loam); Subsurface is various (clay-sandy clay loam-sandy loam-sandy clay)
SOIL CLASSIFICATION	Cryoboralfs-Eutroboralfs [80%]
TOTAL LIVE COVER	157.5% (101.1-270.6%)
NUMBER OF SPECIES	28.3 (24-39)
TOTAL LIVE COVER/NO. SPECIES	5.8% (3.7-10.8%)
CLIMATE	In deep to moderate rainshadow. Cold to very cold, slightly exposed to sun, slightly exposed to wind.
WATER	The soil surface is cool and dry, but water is held in the Argillic horizon about 11 in below the surface, sufficient to maintain a spruce canopy. No permanent water on or near sites.

Table 05-8. Wildlife values (relative to the whole UGB) for the principal wildlife species using *Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly*.

CT	Mule Deer Season–Preference	Elk Season–Preference
All	Winter, Mild– Very Low Winter, Severe– Very Low Spring/Fall– Mod. Low (Cover)	Winter, Mild– Very Low Winter, Severe– Very Low Spring/Fall– Mod. Low (Cover)

Key to Community Types

1. Aspen dominant over Engelmann spruce ..... **B**
1. Spruce or lodgepole pine dominant ..... (2)

2. Spruce (blue or Engelmann) dominant over aspen. Lodgepole pine absent or <1% ..... **A**
2. Lodgepole pine >40%. Spruce <20% ..... **C**

Description of Community Types

A *Blue spruce-aspen-kinnikinnick* Blue spruce cover is >10%. Aspen is always present, but sometimes in small quantities. Tree composition was variable: in one plot Douglas-fir was dominant over aspen, blue spruce, and Engelmann spruce; in another plot, mixed spruce species were dominant over aspen; and in the third plot was composed of blue spruce and very little of other species.

B *Aspen-Engelmann spruce-Idaho fescue-kinnikinnick* The one plot had aspen dominant over Engelmann spruce.

C *Lodgepole pine-aspen-sparse spruce-common juniper-kinnikinnick-elk sedge* Lodgepole pine cover is >45% and aspen cover is >10%. In one plot, aspen was dominant over lodgepole pine and blue spruce; in the other plot, lodgepole pine was dominant over aspen and Engelmann spruce.

Table 05-9. Community types within *Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly*.

Community Type	ns	Elevation, ft Slope, %	Coarse, % Depth, cm Mollic Depth, cm	Surface Coarse, % Bare, % Seral Stage	Lr	Layer Height, m	Avg Lyr Cvr %	Cover, %: Trees Shrubs Graminoids Forbs	No. Species Total Live Cover, % TLC/NS, %	Obstruction %: 1.5-2.0 m 1.0-1.5 m 0.5-1.0 m 0.0-0.5 m Total<2m
A. Blue spruce-aspen-kinnikinnick	3	9,757 (9,470-9,900) 16.3 (12-24)	47 (29-64) 64 (51-73) 6 (0-12)	5 (1-12) 0 (0-0) LS	T1 T2 T3 T4 S1 S2 GF S3 M L	47 (20-70) 15 (2-25) 8 (5-16) 3 (0.0-4) 1.2 (0.3-2.0) 0.3 (0.2-0.5) 0.2 (0.0-0.5) 0.1 (0.0-0.1) 0.0 0.0	50.3 12.0 23.3 12.7 1.6 6.1 22.1 15.8 10.0 5.4	86 (61-114) 22 (15-34) 8 (1-13) 7 (1-17)	27 (24-29) 123 (101-159) 4.7 (3.7-6.6)	100 90 70 70 83
B. Aspen-Engelmann spruce-Idaho fescue-kinnikinnick	1	10,480 9	*	3 15 LM	*			70 10 36 22	26 138 5.3	*
C. Lodgepole pine-aspen-sparse spruce-common juniper-kinnikinnick-elk sedge	2	9,525 (9,400-9,650) 17.5 (16-19)	57 (50-65) 49 (47-50) 8 (4-12)	3 0 MS	T1 T2 T3 T4 S1 S2 GF S3 M L	Missing 20 (12-25) 10 (5-15) 2.3 (0.3-5.0) Missing 0.5 (0.3-0.7) 0.2 (0.0-1.1) 0.1 (0.0-0.3) 0.0 0.0	M 63.1 24.1 15.0 M 5.0 58.4 40.2 0.4 3.4	99 (75-123) 47 (38-56) 51 (13-90) 21 (19-23)	32 (25-39) 219 (168-271) 7.6 (4.3-10.8)	45 (15-75) 33 (25-40) 53 (45-60) 55 (50-60) 46 (38-55)

*. Unknown: measurements were not taken in this CT.

Table 05-10. Resource Values for *Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly*. Resource values were calculated from the numbers in Table 05-9, relative to the whole UGB.

The numbers in this table can be translated: 0 = Very Low, 1 = Low, 2 = Moderately Low, 3 = Moderate, 4 = Moderately High, 5 = High, and 6 = Very High.

	Community Type				Community Type		
Resource Value	**A**	**B**	**C**	**Resource Value**	**A**	**B**	**C**
Potential Cattle Forage Production	1	2-3	2-3	Deer & Elk Forage & Browse	2	4	2
Grazing Suitability	1	1	1	Need for Watershed Protection	3	3	3
Potential Timber Production	4-5 - PIPU	4-5 - POTR5	4-5 – POTR5	Soil Stability	5	4	4
Timber Suitability	5	5	5	Risk of Soil Loss-Natural	1	2	2
Developed Recreation	3	3	3	Risk of Soil Loss-Management	2	2	2
Dispersed Recreation	4	5	5	Risk of Permanent Depletion-Range	1	1	1
Scenic	1	2	2	Risk of Permanent Depletion-Wildlife	1	1	1
Road & Trail Stability	6	5	5	Risk of Permanent Depletion-Timber	4	3	3
Construction Suitability	5	4	4	Resource Cost of Management	4	3	3
Deer & Elk Hiding Cover	6	1-2	3-5	Cost of Rehabilitation	2	1	1

View in a spruce/kinnikinnick stand (Community Type A) farther up the slope from blue spruce/Arizona fescue stands. This stand is obviously colder and the canopy is more closed. Blue spruce 70% cover, kinnikinnick 16%, Engelmann spruce 10%. The mix of trees varies from almost pure blue spruce at lower elevations to almost pure Engelmann spruce at upper elevations. No Douglas-fir is seen, but occasionally a single subalpine (corkbark) fir occurs. Coarse Fragments Cover = 12%, Total Live Cover = 101%, Coarse Fragments in Soil = 32. Soil sampled as an Aridic (or Dystric) Ustochrept, Loamy-Skeletal, Mixed.
Cold Spring Park Quadrangle, elevation 9,900 ft, 24% 310° (NW) slope. August 18, 1992.

Table 05-11. Common Species in *Blue-Engelmann spruces/kinnikinnick–Light-colored soils–Northerly*, where Characteristic cover > 10% or Constancy > 20%. "–" means that the species is not found. Dead cover is not listed. Ccv = Characteristic Cover, Con = Constancy. If Avc = Average Cover, then these are related using the formula Avc = Ccv•100%/Con.

		COMMUNITY TYPE A		COMMUNITY TYPE B		COMMUNITY TYPE C		
		Ccv	(Con)	Ccv	(Con)	Ccv	(Con)	
Code	Species	N =	3		1		2	Common Name
	TREES							
PIEN	Picea engelmannii	32	(67)	10	(100)	4	(50)	Engelmann spruce
PIPU	Picea pungens	35	(100)	–	–	4	(50)	blue spruce
PICO	Pinus contorta	T	(33)	–	–	54	(100)	lodgepole pine
POTR5	Populus tremuloides	9	(100)	60	(100)	41	(100)	quaking aspen
PSME	Pseudotsuga menziesii	61	(33)	–	–	–	–	Douglas-fir
	SHRUBS							
ARUV	Arctostaphylos uva-ursi	20	(100)	5	(100)	19	(100)	kinnikinnick
JUCO6	Juniperus communis	2	(100)	5	(100)	18	(100)	common juniper
MARE11	Mahonia repens	–	–	–	–	5	(100)	Oregon-grape
PEFL15	Pentaphylloides floribunda	T	(67)	–	–	–	–	shrubby cinquefoil
ROWO	Rosa woodsii	1	(67)	–	–	2	(100)	Woods rose
SHCA	Shepherdia canadensis	T	(33)	–	–	6	(50)	russet buffaloberry
	GRAMINOIDS							
CAGE2	Carex geyeri	3	(33)	–	–	48	(100)	elk sedge
CARO5	Carex rossii	1	(100)	–	–	–	–	Ross sedge
FEAR2	Festuca arizonica	1	(67)	–	–	1	(50)	Arizona fescue
FEID	Festuca idahoensis	–	–	30	(100)	–	–	Idaho fescue
FETH	Festuca thurberi	10	(33)	–	–	2	(50)	Thurber fescue
KOMA	Koeleria macrantha	1	(67)	6	(100)	–	–	prairie junegrass
	FORBS							
ACLA5	Achillea lanulosa	T	(100)	2	(100)	2	(100)	western yarrow
ANRO2	Antennaria rosea	–	–	2	(100)	T	(50)	rose pussytoes
ASAL7	Astragalus alpinus	4	(67)	–	–	1	(100)	alpine milkvetch
BODR	Boechera drummondii	–	–	T	(100)	T	(50)	false-arabis
CHDA2	Chamerion danielsii	–	–	T	(100)	1	(50)	fireweed
ERSU2	Erigeron subtrinervis	T	(33)	T	(100)	–	–	threenerve fleabane
FRVI	Fragaria virginiana	6	(33)	–	–	3	(100)	Virginia strawberry
GASE6	Galium septentrionale	–	–	–	–	1	(100)	northern bedstraw
LUAR3	Lupinus argenteus	5	(33)	–	–	6	(50)	silvery lupine
POHI6	Potentilla hippiana	1	(33)	2	(100)	–	–	horse cinquefoil
SOSI3	Solidago simplex	T	(67)	–	–	–	–	Mt. Albert goldenrod
VISO	Viola sororia	–	–	10	(100)	–	–	downy blue violet
	GROUND COVER							
.BARESO	bare soil	T	(33)	15	(100)	T	(50)	
.LITTER	litter and duff	94	(100)	82	(100)	98	(100)	
GRAVEL	gravel 0.2-10 cm	4		–		T		
.COBBLE	cobble 10-25 cm	–	–	–	–	2	(50)	
.STONES	stone > 25 cm	–	–	–	–	–	–	
.MOSSON	moss on soil	10	(100)	–	–	1	(50)	
LICHENS	lichens on soil	5		4		7		